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A WELFARE ANALYSIS OF PRODUCTION AND
CONSUMPTION OF BROADBEANS IN EGYPT

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Abstract

This paper describes the production, marketing, and trade policies for broadbeans in Egypt and quantifies the welfare losses associated with these policies. Beans are heavily subsidized and rationed to consumers, and until very recently producers have been required to deliver quotas of part of their production to the government at prices that have been below world market levels. These inefficient policies have required that Egypt import increasing quantities of beans through time in order to satisfy consumer demand. A free market for beans has developed in rural areas, however, and this market has reduced both demand-side and supply-side welfare losses.
A WELFARE ANALYSIS OF PRODUCTION AND CONSUMPTION OF BROADBEANS IN EGYPT

Introduction

The broadbean is both heavily subsidized and rationed in Egypt, and is the basic staple for breakfast for most Egyptians in both rural and urban areas. Prices to domestic bean producers for mandated quotas are fixed by government decree. Because of this distorted pricing policy the government has had to import large quantities of beans in recent years to balance supply and demand. Thus, the government budget is affected by the subsidy to consumers, fixed producer prices, and imports. Therefore, virtually every Egyptian is touched in some way by policies relating to this commodity.

This paper aims to describe and explain the production, marketing, and trade policies associated with broadbeans (hereafter referred to simply as beans) and to conceptualize and quantify the basic efficiency and equity impacts of these policies.

It is well to emphasize that beans are representative of a number of food commodities that are subsidized and rationed in Egypt. Rice, sugar, cooking oils, and lentils are other examples. The methods utilized here to gauge the welfare impacts of governmental policies could be used also for these commodities.

The cultivated area in beans was about 237,731 feddans in 1981 (see Table 1), the lowest figure in the preceding decade. (A feddan is roughly one acre.) Production also reached a decade low in 1982, because of lower yields as well as the smaller area planted. (See columns 2, 3, and 4 of Table 1). By importing to cover the
demand-supply gap, government budgetary resources had to be converted into foreign exchange that was needed for the international transactions. This impact on the budget could be mitigated if outlays to producers were reduced on the mandatory delivery of the bean quota. Indeed, this is precisely what the government did by setting producer prices below the border price for imports before 1982. In 1982, however, the mandatory quota imposed on producers was eliminated altogether. Of course, compared to a situation where producer and consumer prices would have been established in free and open markets, the policies just described have discriminated against producers and have benefitted consumers to the extent that they could obtain subsidized supplies. The point must not be lost, however, that even consumers have sacrificed consumer's surplus when excess demand could not be eliminated by importation.

This brief summary picture can be completed by pointing out that a free market for beans exists, principally in rural areas where beans are produced. Since production generally exceeded the quota requirement before 1982, producing families had supplies that could be used for home consumption or could be traded on the open market.

This paper is composed of four additional sections. The first describes in the greater detail the quota and marketing system for this commodity in Egypt. The second focuses on demand and consumption issues. The third discusses the distribution system, how prices are determined, and the subsidy question. The fourth section presents a welfare analysis of Egypt's pricing, trade, and quota policy for beans.
Some policy implications of the results are presented in a concluding section.

The Quota and Marketing System

The existing marketing system was initiated in June, 1975. Bean prices were escalating rapidly, and the government elected to embark on a rationing program whereby fixed quantities of beans would be allocated to consumers by the Ministry of Supply at subsidized prices.

On the supply side, before 1982 bean producers were obligated to deliver a specified amount of their production, called the quota, to government collection centers. The quota varied from one governorate to another depending on factors affecting yield, such as soil fertility and water availability. Fines were imposed on producers who did not deliver the required quota. The General Authority of Supplied Commodities then took the beans and distributed them to the official distribution outlets of the various governorates.

The quota in each governorate had to be integrated with the land allotment system which sets cropping patterns and thus determines the area devoted to bean production. Land allotments to each crop vary by governorate and are administratively determined by the Ministry of Agriculture (MOA) through its offices in the governorates.

As suggested earlier, pressure on the government budget from the subsidy and rationing system is probably the root cause for the quota and land allotment policy for beans (and other crops); and thus from the point of view of the government, the system might appear to be fully justified. From the viewpoint of the farmer, however, it is apparent
that these regulations produce results that are inimical to an efficient allocation of resources and reduce his net income. It is not only a question of the different goals of the farmers and the government. If the regulations are inefficient in allocating resources there is a social cost that must be borne ultimately by consumers as well. The national income will be less than it might have been and standards of living on average will be reduced.

The land allotment scheme that dictates the area that each producer must plant to the various crops, effectively removes the cropping-pattern decision from the producer and gives it to the government. This is likely to be inefficient, since only the producer has the incentive to collect and analyze the information on relative costs and prices of various crops and apportion acreage to those crops that will maximize his well-being. This matter is especially critical in costing out the factors owned by the farmer and his family. Government personnel could not possibly know the specific opportunity costs of land, water, the operator's management, family labor, etc., that are unique to each farm and which are needed to determine optimal cropping patterns.

If the farmer violates the land allotment regulation he must face the high probability of paying a fine which could be costly for him. One piece of evidence that indicates that the land allotment scheme is indeed inefficient is the fact that there are many reported cases of producers ignoring the acreage restrictions and paying the fine. This would suggest that the profits captured by ignoring the acreage requirement are at least as high as the fine.
The economic effects of a mandatory quota imposed on producers are somewhat complex. Some simplifying assumptions will enable us to see why. Assume that all bean markets in Egypt are interconnected and supplies are free to move to markets where they bring highest net returns to the sellers (not a completely valid assumption since trade barriers exist that prevent produce movement from one governorate to another). Further, let us assume that all bean markets have equal demand price elasticities. Then a quota system, which has the effect of reducing beans going to rural free markets and increases the supply to urban consumers, will increase the free market price in rural areas but decrease it in whatever free markets might exist in urban areas. Consumers in rural areas would be worse off and those in urban areas would be better off than if the quota system did not exist. Further, if the quota price paid to producers is below the free market price in rural areas, and beans are rationed to consumers at subsidized prices, there is a transfer of wealth from bean producers to bean consumers. We will discuss this point further below.

In addition, risk may be an important element in the decision of whether or not to deliver the quota or simply trade in the free market. The quota price is usually known in advance of the growing season, whereas the free market price is not. There may be considerable price fluctuations through time in the free market, and a highly risk averse seller may require a premium over the quota price on average to induce him to bear these price risks. Unfortunately, since we have little or no information about risk preferences, these matters will receive little attention in this paper.
Bean Consumption in Egypt

In both urban and rural areas beans have historically been the most important source of protein in the diet for most people. The average annual per capita utilization was 5.98 kg over the period 1971-79. Bean consumption has been declining in recent years, however. In 1972-73 annual per capita consumption was 7.8 kg, but by 1979 it had fallen to 4.9 kg.

The Family Budget Survey of 1974-75, sponsored and published by the Central Agency for Public Mobilization and Statistics, has been analyzed by Ismail, Gardner, and Abdou (1982). The data in Table 2 corroborate that beans are consumed by all income classes in both urban and rural areas. Granulated beans (usually prepared as a porridge or fried as a beancake) are identified separately from nongranulated beans (usually boiled). The data do not include expenditures for ready-to-eat beans and beancake, which are prepared and sold in shops outside the home, so the consumption picture is incomplete.

The data in Table 2 imply that nongranulated beans were a superior good in both urban and rural areas, since expenditures rose as income increased. Granulated beans, on the other hand, appeared to be superior in rural areas but were inferior in urban areas.

Data from the Family Budget Survey were also utilized to estimate the distribution of consumption across 13 income classes. The sampled data were recorded in physical units; i.e., per capita consumption in kilos. Gini coefficients were calculated. A Gini value of zero would imply equal consumption across income classes, whereas values approaching 1 would imply high degrees of concentration in consumption.
The Gini values for nongranulated beans were 0.09 for urban areas and 0.17 for rural areas. The corresponding values for granulated beans were 0.06 for urban areas and 0.09 for rural areas, respectively. All these coefficients are relatively low, implying relative equality of consumption across income classes.

As pointed out above, in recent years Egypt has imported significant quantities of beans: in 1977, 23,000 tons; in 1978, 32,000 tons; in 1979, 26,000 tons; in 1980, 37,000 tons; and in 1981, 92,000 tons. The principal suppliers have been Holland, Poland, the United Kingdom, Ethiopia, Canada, and Morocco. Average import prices were far above prices paid to domestic producers on quota deliveries in these years. (See Table 3, columns 2 and 5.)

Ismail, Abdou, and Gardner (1982) attempted to account for the final disposition of food commodities purchased by Egyptian families in urban and rural areas. Of the total quantity of beans available to the rural family in the sampled area, an average of about 28 percent of the beans was fed to animals or was wasted (unaccounted for), the largest fraction for any commodity. In urban areas the corresponding figure was 9 percent. Beans are often included as a concentrate in a feed mix for animals, especially poultry. Also, they are quite susceptible to damage from weavil, in which case they may be deemed unfit for human consumption and are fed to animals.

The Distribution System, Pricing, and Subsidies

The government abandoned the mandatory quota system after 1980-81 and relied on voluntary delivery by the producers. Because of the
disparity between free market and government prices, however, the
delivery of beans to the government collection centers was only about
40,000 tons in 1980-81. One wonders why even this much was
delivered. Along lines argued earlier, one reason may be that some
farmers are highly risk averse and prefer a firm government price than
taking their chances in the more uncertain free market. Also, it is
possible that free markets either may not exist everywhere or access to
some farmers may be sufficiently costly so that government centers would
be the more profitable marketing alternative.

Let us now review the disposition of beans for the year 1980-81.
The government needed about 203,000 tons to meet the consumption
requirements of the official distribution system and allocations to the
security forces. Thus, approximately 163,000 tons must have been
imported to fill the gap between these requirements and the domestic
supply (40,000 tons) delivered to the government.

The Ministry of Supply is responsible for the distribution of the
available supply to the governorates. In recent years, the ration book
usually gave each family an entitlement of about one kilo per month,
although precise amounts depended on quantities available. To describe
this situation where rationed quantities vary, the term "semi-rationed"
is used. Since there are approximately 8 million ration books in
use, the average annual requirements of the rationing system have been
about 96,000 tons. The price of the rationed beans is fixed at
10 piasters (abbreviated as p.t.) per kilo or L.E. 100 per ton. If
additional quantities are available (about 22,000 tons were in 1980-81)
each holder of a ration book may purchase a pro-rata share at 15 p.t. per kilo. These beans are generally in granulated form.

About 18,000 tons were allocated to the security forces. This leaves about 67,000 tons in government hands to be distributed to the governorates where they are sold in private retail shops, restaurants, and government cooperatives at a price of 35 p.t. per kilo. Many of these beans are sold unrationed in the form of cooked beans and bean cakes (or sandwiches, as they are called).

Domestic production was estimated at 207,788 tons in 1980-81 (see Table 1). After delivery to the government of 40,000 tons is subtracted, this leaves 167,788 tons to be either consumed at home by the producer family or traded in the open market. It is known that free market prices vary among governorates, but no systematic study has been made of these markets or prices in these markets. There are unofficial reports, however, that the price for raw beans was approximately 50 p.t. per kilo in the open market in 1980-81.

The quota price per ton was L.E. 58 in 1971, L.E. 105 in 1977, and L.E. 235 in 1981. (See Table 3.) Despite the fact that these nominal prices of beans received by producers have been increasing, it is doubtful if they have increased much in real terms, since they are shifted through time by a cost-of-production index.

Table 3 also contains some wholesale and retail prices for whole beans. Wholesale prices appear to represent the cost to the Ministry of Supply of procuring beans from the farmers (the quota price) plus the costs of transportation, storage, and handling as the beans are moved to the final consumer. The retail price is an average of prices paid by
consumers. The margin between wholesale and retail prices is higher than that between quota and wholesale prices.

Using a cost-of-production index to change producers prices through time will not be conducive to achieving economic efficiency. Demand-side factors are ignored completely. If tastes and preferences or incomes shift to increase consumer marginal valuations of a commodity such as beans, a free market would initially give a signal in the form of an increase in the relative price. *Ceteris paribus*, the profitability of growing beans relative to other crops would increase and the supply of beans would be expected to rise, providing farmers were free to alter input commitments to alternative crops. If relative costs did not change, equilibrium might be re-established at the old price, but at a higher level of output. All of this would be consistent with efficient resource allocation. If consumer valuations are excluded from the price-making process, and only cost-of-production, supply-side factors are utilized, signals to producers would be incomplete and resources would not be shifted to efficient employments.

Use of cost-of-production indices for pricing of quota beans may be inefficient for other reasons as well. Costs are categorized as fixed and variable, and many estimation problems exist in selecting a value to represent these costs. For example, one of these fixed costs, land rent, is officially established by the Land Reform Law at seven times the land tax. Actual rents paid may be much more since enforcement of the law is costly and often lax. The result is an understatement of true costs by the index which uses the official rent. Producers also believe some variable costs, such as labor and machinery, are also
understated in the index since actual costs are often higher than costs based on "official" prices. The upshot is that quota prices based on understated costs of production do not increase so fast as actual costs do. The obvious result is to discriminate against producers who deliver quota, since prices are not even as high as the law intended that they should be.

Fortunately, from the point of view of allocative efficiency, the bulk of the bean production in Egypt is not guided significantly by the prices paid for quota. Since most of the production is consumed at home or is sold in the free market, where prices are established by both supply and demand forces, it can be assumed that most producers will look to the free market for price signals to guide production decisions. In free competitive markets, prices represent the marginal values of trading consumers and the marginal supply costs of trading producers. Thus, if producers and consumers are guided in their decisions by competitive prices, the resulting resource allocations are likely to be efficient.

Let us now consider the matter of the subsidy to consumers, the difference between government costs and what consumers pay. As was pointed out above, in 1980-81 retail prices were L.E. 100 per ton for rationed beans, about L.E. 150 per ton for granulated beans purchased at government shops as available, about L.E. 350 per ton for beans going to restaurants, shops, hotels, etc., and approximately L.E. 500 in the free market. Given this complex pricing system what is the subsidy, if any, given to bean consumers?
The Ministry of Supply has estimated that the average subsidy received by consumers of imported beans was L.E. 219 per ton in 1980-81, while the subsidy on domestic beans procured through the quota was estimated at L.E. 67 per ton. The reason for this substantial difference is the higher procurement and handling costs of imported beans. The Ministry has calculated the weighted average subsidy of the two at L.E. 189, which makes sense given the larger quantities of imported beans handled by the government.

This estimate fails to take into account an important consideration, however. The Egyptian government overvalued the Egyptian pound throughout the 1970's by fixing the exchange rate below the "shadow" or free market rate. In 1980-81, the official rate was L.E. .7 per U.S. dollar, whereas the shadow rate ranged from about .7 to .86 per dollar (Glassburner 1982). Official government-to-government international transactions are usually conducted at the official rate of exchange. Private trader transactions, however, are usually carried out in dollar denominations and dollars must be obtained in the foreign exchange market at the free shadow price. If all bean imports had been purchased at the shadow price, the dollar costs would have been substantially higher than the official costs suggest and the subsidy to consumers would be higher than indicated previously.

The Analytical Model and Estimates of Welfare Efficiency Losses

We have argued above that the policy of fixing domestic producer prices for quota deliveries and pegging consumer prices below world
border levels reduces real incomes of Egyptian bean producers and increases those of Egyptian bean consumers compared to free market outcomes. These are the primary distributive consequences of the current policy. But what are the implications of this policy for efficient resource allocation in the economy as a whole?

The conceptual apparatus for the welfare analysis appears in Figure 1. $S_d$ is the domestic supply curve for beans that represents the marginal opportunity costs of supplying beans to the economy by domestic producers. $D$ is the demand curve that stands for the marginal valuations of Egyptian consumers for various quantities of imported and domestically-produced beans that are consumed. $P_p$ is the government fixed price offered to domestic producers for the delivery of quota (approximately L.E. 235 per ton in 1980-81). $P_w$ is the border price of imports. To obtain the L.E. price, the cif dollar prices paid to foreign suppliers in 1980-81 were averaged, weighted by the quantities procurred, and converted to Egyptian pounds at both the official exchange rate of L.E. .7 per dollar and the shadow rate of L.E. .855 per dollar that prevailed in 1980-81. These calculated prices were L.E. 303 and L.E. 371, respectively.

As explained earlier, domestic production not delivered under the quota was either consumed at home by the farm family or was sold on the open market. $P_f$ represents the open-market price in 1980-81. Although systematically collected data are not available, scattered observations would indicate that a typical price was approximately L.E. 500 in 1980-81.
Q_d in Figure 1 is the quantity domestically produced (in 1980-81 about 208,000 tons). Q_t is the total quantity available for consumption and includes domestic production and imports (imports were about 163,000 tons in 1980-81, making Q_t 375,000 tons). Q_p and Q_e will be explained later.

Considering both imports and domestic supply, the minimum-cost supply curve to the economy is abc in Figure 1, consisting of domestic supply so long as domestic marginal costs are lower than border import price, and thereafter the border price. We assume that world market prices are unaffected by the activities of Egyptian traders which implies that the import supply curve facing Egypt is perfectly elastic. This assumption may not be valid if the world market for beans is thin relative to Egyptian international demand, which would imply some monopsony power. If Egypt had to pay higher prices for incremental quantities, the segment bc would slope upward. We have no evidence that such is the case.

The existence of an open market where prices are relatively free to seek an equilibrium level where demand equals supply is critical for estimating marginal consumer valuations. If P_f is the domestic free market price and the market is in equilibrium, it must mean that at the margin consumers value beans at P_f, otherwise there would be unsatisfied demand and the price would be bid up, or alternatively, markets would not clear of existing supplies and the price would fall. If producers receive P_f in the open market it must mean that at the margin they value home consumption at P_f, assuming trading costs are zero. Otherwise, they would offer more or less for sale rather than consuming it.
Conceptually, policy may misallocate resources by creating price distortions that cause consumers and producers to make inefficient allocative decisions. For example, if domestic producers are paid less than the world price for beans and the government imports at the world price, then at the margin the costs of domestic production can be expected to be less than the costs of importation, implying fewer resources are devoted to domestic production than would be at the efficient level. Let us call these producer effects supply-side welfare losses.

On the other hand, the government may restrict imports to the point where consumers may pay more for beans at the margin than the world market price. This wedge implies that the marginal valuations of consumers are higher than the costs to the economy of procuring beans in the world market, again implying inefficiency. Let us call this type of misallocation "demand-side" welfare losses. We will now proceed to estimate these demand-side and supply-side welfare costs of existing import and pricing policies.

**Demand-side Welfare Losses**

The total domestic consumption ($Q_t$) was 371,000 tons in 1980-81. We assume that the demand curve for beans passes through some point at the quantity of 371,000 tons. But what is the height of the demand curve at this quantity; i.e., what is the marginal valuation of consumers for this quantity? If marginal purchases occur in the open market for beans at a price of L.E. 500 per ton, it can be reasonably assumed that the marginal valuation is at least this much.
(Inframarginal quantities would be worth more if the demand curve is downward sloping.) This assumption allows us to establish a point on the demand curve at \((P_f, Q_t)\) in Figure 1. The marginal valuation by consumers of L.E. 500 at this quantity is higher than the border price of L.E. 303, calculated at the official exchange rate, or L.E. 371, calculated at the shadow rate. Consumers are foregoing consumer's surplus by the failure of the government to import beans to the point where the marginal valuation is equal to the border price \((P_w, Q_e)\) in Figure 1. If a linear demand curve is assumed, the welfare loss is one-half \((P_f - P_w)\) times \((Q_e - Q_t)\), shown as area 1. This loss can be computed if \(Q_e\) can be estimated, since the other variables needed for the calculation are known.

One way of estimating \(Q_e\) is to use an elasticity of demand, \(E_d\), to extrapolate the demand curve downward to quantity \(Q_e\). This quantity can be solved for by using the formula for arc elasticity.

Suppose \(E_d\) is assumed to be \(-0.10\), and the values for \(Q_t\), \(P_f\), and \(P_w\) are as indicated above. Solving the arc elasticity formula for \(Q_e\) yields 390,000 tons that would have been demanded if the price had been the border price of L.E. 303, and 382,000 tons if the border price had been L.E. 371. Substituting \(Q_e\) into the welfare loss equation yields an estimate of foregone consumer's surplus of L.E. 1,871,000 at the official foreign exchange rate of L.E. .70 per dollar and L.E. 720,000 at the shadow rate of L.E. .855 per dollar.

Table 4 contains estimates of consumer's surplus foregone at assumed elasticities of demand of \(-0.10\), \(-0.22\), \(-0.50\), and \(-0.75\). The data are presented this way for two reasons: (1) elasticities of demand
for beans have not been estimated econometrically and we did not have the data to do so, and (2) we wanted to see how sensitive the demand-side welfare losses are to the magnitude of the elasticity estimates. As elasticity rises in absolute terms, the quantity response to price reductions increases and consumer's surplus foregone enlarges. This is clearly evident in Table 4.

It is also evident from Table 4 that the demand-side welfare loss is sensitive to the foreign exchange rate utilized in converting the dollar border price into Egyptian pounds. (The numbers in parentheses in Table 4 are the welfare losses calculated at the shadow exchange rate.) The effect of using the higher shadow exchange rate is to raise the border price, \( P_w \), and make the difference smaller between the border price and the price received by farmers in the domestic open market, \( P_f \). Of course, this reduces the consumer's surplus foregone.

On the matter of the choice of an exchange rate to use in such a calculation, we would opt for the shadow rate rather than the official rate on theoretical grounds. As an approximation to a free market rate, it represents better the real opportunity costs of using scarce foreign exchange to make international purchases.

On the matter of a choice of a demand price elasticity coefficient, given that lentils and other pulses appear to be substitutes for beans over some range, it would appear that a price elasticity for beans of \(-0.10\), or even \(-0.22\), may be too low for Egypt. On the other hand, given the importance of beans in the diet, especially as a breakfast food, it may well be that a price elasticity of \(-0.75\) is too high.
Thus, we would speculate that -0.50 is probably the most likely correct of those considered.

**Supply-side Welfare Losses**

As postulated in economic theory, producers in perfectly competitive product markets are assumed to push production levels of a given crop to the point where the marginal opportunity cost of production equals the expected product price. A question arises when the farmer faces various prices for his output. For example, the farmer growing beans in Egypt in 1980-81 could receive a price of approximately L.E. 235 per ton on quota delivered to the government and it appears substantially more from his sales in the open market. Which price guided his production decision and determined the level of output? It seems to us that the expected free market price is a better reflection of what the farmer might expect to receive from his production at the margin, although clearly the quota price will also affect his total income and ability to acquire purchased inputs. The open market price is a free price, however, and thus is affected by all the factors that influence demand and supply functions. This point raises another complication. Since the farmer cannot possibly foresee accurately all these factors when making planting and production decisions, he probably perceives the free market price as a stochastic variable. If the farmer is risk averse, he will require a risk premium on the price received in the free market. Given information available to us for this study, however, this premium could not be estimated empirically. If every farmer delivered quota as well as sold on the free market, it might be
inferred that at the margin the risk premium might be as much as the difference. That is, that farmer would be indifferent at the margin between selling at the riskless quota price and the higher but risky free market price. We have no way of knowing whether or not farmers sold in both outlets. The most we can say, therefore, is that for planning production the free market price should be considered as an upper-limit estimate of nonrisky marginal returns.

Let us assume that the farmer is unconstrained in his purchase of inputs that he deems profitable to utilize; i.e., he expects marginal benefits of employing inputs to be equal to the input price. In product space, he will expand output to the point where the marginal opportunity cost equals the product price. Let us assume initially that the observed 1980-81 price of beans in the open market was the expected price guiding farmer decisions. It follows that in Figure 1 the farmers would have expected to produce $Q_d$ quantity of beans. If we assume that actual production was equal to expected production, we know this observed output to be about 208,000 metric tons. This reasoning allows us to establish a point on the supply curve.

It is clear from Figure 1, however, that so long as the open market price is higher than the border price, more resources will be utilized per unit to produce beans domestically than would have been expended at the margin to import them and thus resources are wasted. This conclusion assumes that government transport and handling costs are the same whether the beans are imported or are purchased by the government from domestic producers. We have no reason for believing that this assumption is not valid.
Conceptually, the supply-side misallocation resulting from import restriction is the excess domestic cost above the minimum-cost supply curve \(abc\) (area 2 in Figure 1). If the supply curve is linear, this welfare loss can be estimated as one-half \((Q_d - Q_p)\) times \((P_f - P_w)\). Since we know precisely that \(Q_d\) and \(P_w\) were in 1980-81, to solve for the supply-side welfare loss we need to know \(Q_p\) and \(P_f\).

\(Q_p\) is the domestic production that would have been forthcoming had the border price been the price received by domestic producers. \(Q_p\) can be estimated if the average price elasticity of supply is known over the arc between points \((P_w, Q_p)\) and \((P_f, Q_d)\) in Figure 1. Since we do not have reliable estimates of the elasticity of supply for growing beans in Egypt, nor the data for estimating them, we simply assumed elasticities of 0.25, 0.50, and 0.75 and calculated corresponding \(Q_p\)'s and associated welfare losses. These supply-side losses appear in Table 4.

Given that the government attempts to control cropping patterns, our guess is that a supply price elasticity of 0.75 may be too high even in the long-run. It is well-known, however, that farmers often opt to violate the cropping pattern restrictions and pay the fine imposed for doing so. Since this is not a costless response, however, it is difficult to know exactly what this implies for selecting a valid price elasticity of supply for beans.

Similar data problems exist in estimating \(P_f\), the price received by farmers in the open market. It was earlier pointed out that consumers were observed to pay an open market price of L.E. 500 per ton. The producer price, however, might be considerably lower, due to various
market imperfections. It appeared prudent to assume producer prices at several levels, L.E. 500, L.E. 400, and the quota price of L.E. 235 per ton.

At the quota price of L.E. 235, the misallocation welfare loss is represented as area 3 in Figure 1. Resources would have been wasted by importing beans at higher costs than would have been expended at the margin by domestic producers.

We must be clear that if producers receive less than L.E. 500 per ton on the open market, then our estimates of the marginal value of home consumption at this level assumed in the demand-side analysis will be too high.

Results and Policy Implications

At a price elasticity of demand of -0.50, the demand-side welfare losses were nearly 4 million pounds in 1980-81 if imports are valued at the shadow exchange rate, and over 10 million if imports are valued at the official rate. At the assumed price elasticity of supply of 0.50, the supply-side welfare losses are less, although under the assumptions of a producer price at the quota level and valuing imports at the shadow rate, the welfare loss was over 3.5 million pounds. One of the reasons for the larger demand-side losses is that the quantity numbers are higher, since they include both domestic production and imports, whereas the supply-side losses are calculated only on the domestic supply.

To put these welfare efficiency losses into perspective, let us assume an elasticity of demand at -0.50, and elasticity of supply at 0.50, the free market price to producers at L.E. 400 per ton, and the
shadow foreign exchange rate. These appear to us to be the most valid assumptions. The demand-side losses in 1980-81 were L.E. 3.82 million and the supply-side losses only L.E. 111 million. The total of L.E. 3.938 million is approximately 9 p.t. per capita per year for the entire Egyptian population. This does not strike us as a terribly large welfare loss. The loss would have been larger if: (1) the free market price to consumers had been more than L.E. 500 per ton, (2) imports had been valued at the official exchange rate, and (3) producers had received more than L.E. 400 per ton in the free market. Of course, the loss would have been even lower under the assumptions utilized if the government had permitted more imports.

Of considerable significance is the existence of the free market in mitigating welfare losses, on the demand side by permitting consumers to have a larger quantity of beans supplied domestically on which they capture consumer's surplus, and on the supply side by permitting farmers to sell produced beans at higher prices than they would have been worth in home consumption.

We believe these results have the following policy implications:

(1) If there is evidence that bean producers receive only the government quota price for free market sales, the quota price should be raised in order to reduce supply-side welfare losses. On equity grounds they should probably be raised anyway, since producer incomes are almost certainly below the national average. If prices were raised to the international level, computed at the shadow rate of exchange, economically efficient signals would be given to bean producers.
(2) If domestic open market prices persist at higher levels than border prices valued at the shadow exchange rate, the government should remove import restrictions from private traders, or increase importation itself. Increasing the rationed entitlement, or semi-rationed quantities at the 15 p.t. per kilo price, would shift demand downward in the open market until the open market price coincided with the border price, thus eliminating demand-side efficiency losses. We would not necessarily recommend this policy, however, even though it might be economically efficient, since it would confer wealth gains on consumers of subsidized beans. As a general rule, the Egyptian economy would work far more efficiently if subsidies could be eliminated, not increased.
References


Footnote

1 If the average price elasticity over the relevant arc of the demand curve is $E_d$, the formula for arc elasticity is

$$E_d = \frac{(Q_t - Q_e)}{(Q_t + Q_e)} \cdot \frac{(P_f - P_w)}{(P_f + P_w)}.$$
Table 1. Area Cultivated, Total Production, and Yields, Beans, Egypt, 1971-1981.

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (Feddans)</th>
<th>Total Production (Tons)</th>
<th>Average Yield (Per Feddan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>261.408</td>
<td>256.226</td>
<td>0.980</td>
</tr>
<tr>
<td>1972</td>
<td>336.646</td>
<td>360.834</td>
<td>1.072</td>
</tr>
<tr>
<td>1973</td>
<td>270.016</td>
<td>272.649</td>
<td>1.010</td>
</tr>
<tr>
<td>1974</td>
<td>234.635</td>
<td>234.130</td>
<td>0.961</td>
</tr>
<tr>
<td>1975</td>
<td>245.574</td>
<td>233.735</td>
<td>0.952</td>
</tr>
<tr>
<td>1976</td>
<td>259.638</td>
<td>254.482</td>
<td>0.980</td>
</tr>
<tr>
<td>1977</td>
<td>291.790</td>
<td>269.697</td>
<td>0.924</td>
</tr>
<tr>
<td>1978</td>
<td>238.954</td>
<td>231.223</td>
<td>0.968</td>
</tr>
<tr>
<td>1979</td>
<td>249.509</td>
<td>235.801</td>
<td>0.945</td>
</tr>
<tr>
<td>1980</td>
<td>244.746</td>
<td>212.672</td>
<td>0.869</td>
</tr>
<tr>
<td>1981</td>
<td>237.731</td>
<td>207.788</td>
<td>0.874</td>
</tr>
</tbody>
</table>
Table 2. Annual Per Capita Expenditures for Beans by Income Class in Urban and Rural Areas of Egypt, 1974-75*

<table>
<thead>
<tr>
<th></th>
<th>Urban Area</th>
<th></th>
<th>Rural Area</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Income Class, L.E.</td>
<td></td>
<td>Income Class, L.E.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0&lt;200</td>
<td>200-800</td>
<td>Over 800</td>
<td>0&lt;200</td>
</tr>
<tr>
<td>Granulated beans</td>
<td>L.E.</td>
<td>L.E.</td>
<td>L.E.</td>
<td>L.E.</td>
</tr>
<tr>
<td></td>
<td>2.46</td>
<td>2.08</td>
<td>1.96</td>
<td>1.40</td>
</tr>
<tr>
<td>Nongranulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>beans</td>
<td>1.79</td>
<td>2.06</td>
<td>3.01</td>
<td>2.07</td>
</tr>
</tbody>
</table>

*Data taken from Family Budget Survey, 1974-75, published by the Central Agency for Public Mobilization and Statistics, Cairo. (Ismail, Gardner, and Abdou, 1982).
Table 3. Producer, Wholesale, Retail, and Import Prices for Beans, Egypt, 1971-1981

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1971</td>
<td>57.55</td>
<td>--</td>
<td>110</td>
<td>--</td>
</tr>
<tr>
<td>1972</td>
<td>54.65</td>
<td>47.1</td>
<td>84</td>
<td>--</td>
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<tr>
<td>1973</td>
<td>53.87</td>
<td>66.0</td>
<td>81</td>
<td>--</td>
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<tr>
<td>1974</td>
<td>86.01</td>
<td>92.4</td>
<td>110</td>
<td>--</td>
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<tr>
<td>1975</td>
<td>104.14</td>
<td>113.7</td>
<td>138</td>
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<tr>
<td>1976</td>
<td>104.97</td>
<td>116.3</td>
<td>149</td>
<td>--</td>
</tr>
<tr>
<td>1977</td>
<td>105.36</td>
<td>123.1</td>
<td>153</td>
<td>256</td>
</tr>
<tr>
<td>1978</td>
<td>134.52</td>
<td>147.2</td>
<td>189</td>
<td>283</td>
</tr>
<tr>
<td>1979</td>
<td>137.43</td>
<td>--</td>
<td>221</td>
<td>361</td>
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<tr>
<td>1980</td>
<td>199.11</td>
<td>--</td>
<td>--</td>
<td>434</td>
</tr>
<tr>
<td>1981</td>
<td>234.72</td>
<td>--</td>
<td>--</td>
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</tr>
</tbody>
</table>
Table 4. Supply-side and Demand-side Welfare Costs for Beans, Egypt, 1980-81

<table>
<thead>
<tr>
<th>Demand-side Welfare Loss</th>
<th>(in L.E.)</th>
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</thead>
<tbody>
<tr>
<td>Ed</td>
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</tr>
<tr>
<td>-.10</td>
<td>1,871,000</td>
</tr>
<tr>
<td></td>
<td>( 720,000)*</td>
</tr>
<tr>
<td>-.22</td>
<td>3,447,000</td>
</tr>
<tr>
<td></td>
<td>(1,612,000)</td>
</tr>
<tr>
<td>-.50</td>
<td>10,244,000</td>
</tr>
<tr>
<td></td>
<td>(3,827,000)</td>
</tr>
<tr>
<td>-.75</td>
<td>16,449,500</td>
</tr>
<tr>
<td></td>
<td>(5,982,000)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply-side Welfare Loss</th>
<th>(in L.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Market Price to Farmers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L.E. 500</td>
</tr>
<tr>
<td>Es</td>
<td></td>
</tr>
<tr>
<td>.25</td>
<td>2,364,000</td>
</tr>
<tr>
<td></td>
<td>( 958,000)( 56,000)</td>
</tr>
<tr>
<td>.50</td>
<td>4,432,000</td>
</tr>
<tr>
<td></td>
<td>(1,850,000)( 111,000)</td>
</tr>
<tr>
<td>.75</td>
<td>6,402,000</td>
</tr>
<tr>
<td></td>
<td>(2,682,000)( 165,000)</td>
</tr>
</tbody>
</table>

*Number in parentheses represent welfare losses calculated under the assumption that the world price in pounds is valued at the shadow exchange rate rather than at the official rate.
Figure 1. Resource Misallocation Costs for Beans